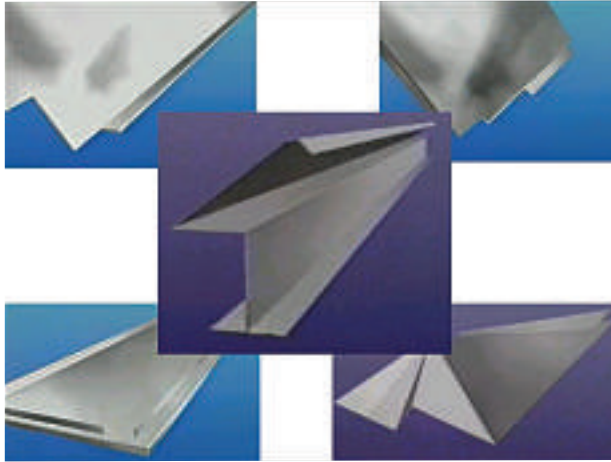# Shaping the future

BendWizard:
A tool for off-line programming of robotic tending systems

Paolo Conca

Setting up a robot to make metal cabinets or cases for desktop computers can be a complex operation. For instance, one expert might be required to carry out a feasibility study, and then another to actually program the robot. Understandably, the need for so much expertise, and the time that's required, generally limits the usefulness of automation to high-volume production.

Workshops producing parts in batches smaller than 50 or so, or which rely heavily on semi-skilled operators, are therefore often discouraged from investing in automation, and so miss out on its many advantages. What is needed is a software tool that operators without special knowledge of robotics, or with no more than rudimentary CAD skills, can use. One which allows easy offline programming and simulation of the work cell on a PC.

Flexible production: this key strategic goal of every modern manufacturing company has made robotic tending of press brake machines a common sight in sheet metal fabrication workshops. And with advantages over manual tending like better quality, higher efficiency, improved safety, less scrap and accurate repeatability, its popularity is certain to grow. One limitation is

slowing its advance, however: traditional programming of a new part is complex and takes considerable time – production downtime that until now has made robotic tending commercially less interesting for small-batch production. Smaller workshops clearly need a software tool that does away with the complexity and saves time through a combination of offline programming and

work cell simulation with a user-friendly interface.

**One, unique programming tool**
ABB developed BendWizard to provide all these features and so offer the benefits of advanced automation to metal fabrication companies producing parts in small- as well as large-batch runs, thereby adding real value to their

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operations. By dramatically reducing robot downtime and making production runs for 50 pieces and fewer economically viable, BendWizard offers smaller workshops a genuine incentive to invest in modern automation systems.

BendWizard represents a significant advance in robotic press brake production. The result of three years of development, it incorporates experience and process know-how accumulated by ABB in a wide variety of press brake tending applications over the last decade.

The latest version of BendWizard gives users of press brakes from ABB-preferred partners a single, unique software tool for programming the entire production cell. Apart from making programming easier, BendWizard offers an unparalleled level of integration between the robot and the press brake, making it the ideal tool for offline programming of a 'new', fully integrated machine: the robotized press brake cell.
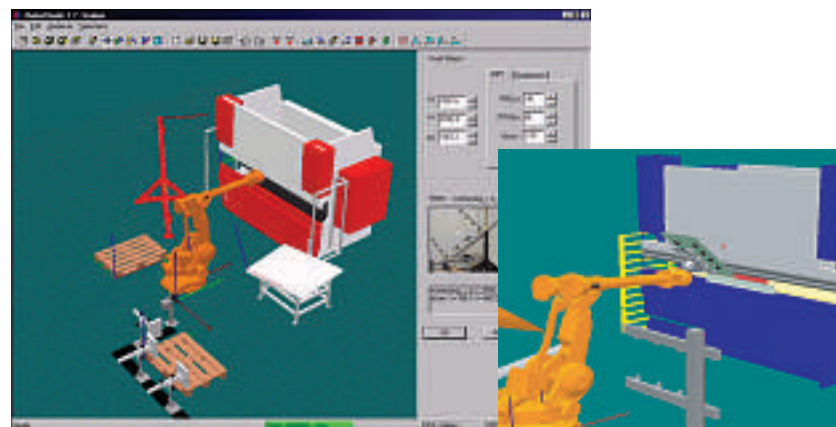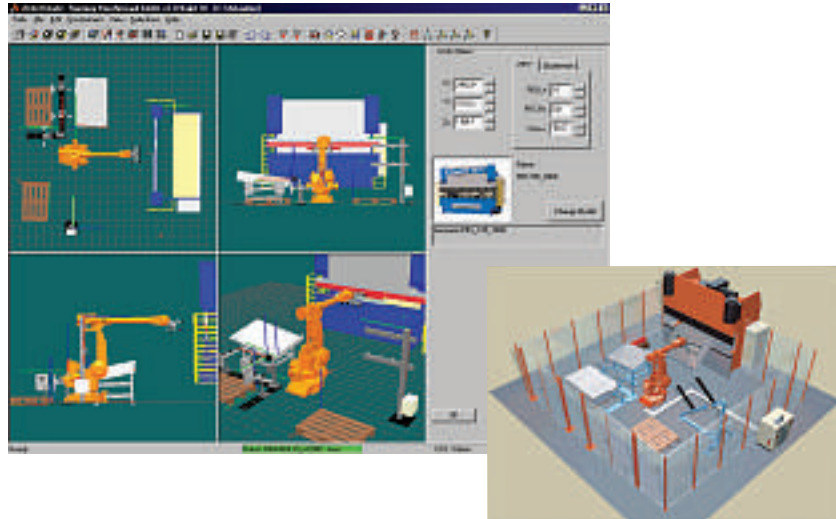
BendWizard and FlexBender

ABB has standardized its solutions for press brake tending applications with a range of function packages, based on the different robot models, for different sheet metal and press brake sizes.

With BendWizard, ABB presents a software product that has been specifically developed for fast and easy offline programming of the entire FlexBender line. BendWizard features 3D graphics, based on 3D solid modeling. Using it, the operator can easily move within the virtual cell and check every detail of

every phase in the bending cycle, completely validating the process in the office before going into the workshop. Thus, there is no interruption of production and ramp-up time is zero.

Programming with Bendwizard

BendWizard's graphic interface and extensive functionality enable machine operators with only limited knowledge of robotics and PC software to program and simulate the robot. The user doesn't

see any of the robot's technical complexity. All the programming is done just as before, starting with the drawing of the flat metal sheet and then moving through the sequence of bends. The user can see the 3D image of the final shape the whole time. The program code is completely transparent to the user all the time it is being written.

The user starts programming a new part by importing the DXF/IGES drawing of the part. Then he generates the virtual

The drawing of the part can be imported from .dxf or .iges files, or can be defined from CAD functions integrated in BendWizard.

A 3D model is used for the feasibility study of a bending job and to check for reachability and possible collisions.
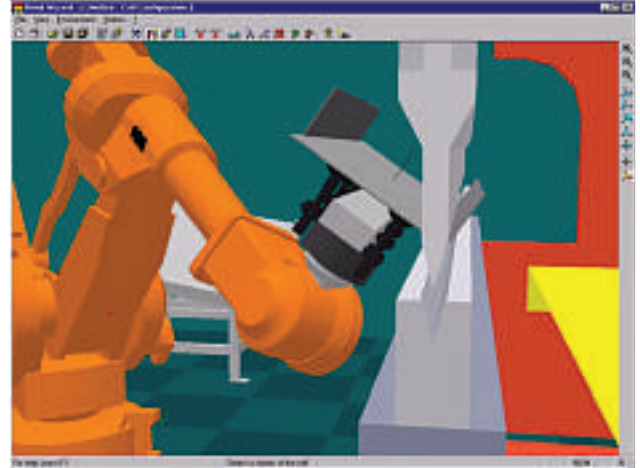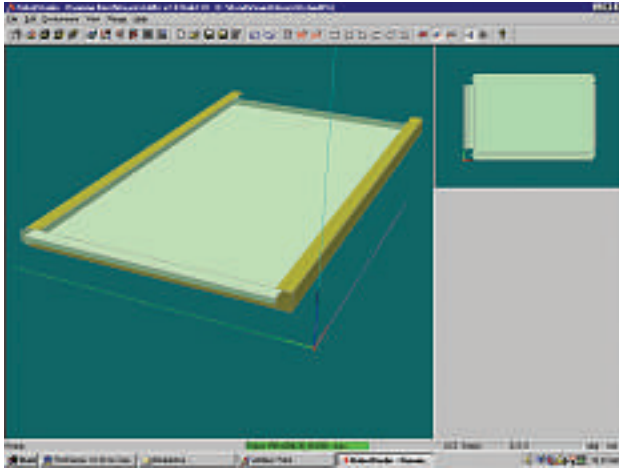
set-up of the press brake using the various tools.

The bending sequence is defined interactively through the simulation of the robot operation and press brake cycle. As the system runs through the bending cycle, it automatically checks at each stage the reachability of the robot targets, the working area and the possibility of collision. If trouble is detected, the user has several tools with which to implement the necessary modifications.

After the system has verified the cycle, the path can be converted into a format compatible with the robot language and the file downloaded to the robot controller. When working with press brakes from ABB-preferred partners, the press part program is also directly generated. After quick, final verification in the workcell, production can start.

Documentation is also made easier. All the data processed by BendWizard

can be converted into reports in HTML format.

Four programming environments

BendWizard software is sequentially structured and comprises four different programming environments:

■ *Working cell configuration and setup* – the definition of the layout through selection of the system components and their positioning. Libraries are available for all the robot models, system modules and models of the press brake.

■ *Part definition* – the definition of the geometry of the part to be programmed through the import of the DXF/IGES drawing or the creation of the drawing by means of an incorporated CAD system.

■ *Workcell set-up definition* – the definition of the set-up of the press brake with the different set of tools required, and of the robot gripper and the other adjustable modules included in the robotic system.

■ *Bending sequence definition* – the generation of the part program.

One platform

One of BendWizard's strong points is its RobotStudio [1] platform – the standard ABB platform for the simulation and programming of robots. RobotStudio guarantees high quality and reliability levels and uses the innovative technology of the Virtual Controller to make the same control system used for the robot available on a PC.

The Virtual Controller communicates with BendWizard to precisely simulate the behavior of the robot in terms of movement, reachability, collision and diagnostics, etc. Exploiting the strategic advantages that derive from the use of a standard ABB platform, BendWizard guarantees that every functional update is linked to the ABB robot upgrades. Ensuring compatibility with RobotStudio was central to the development of the BendWizard software.

A large variety of press brake machines, robots and peripherals are available in the BendWizard libraries for the definition of every type of work cell.
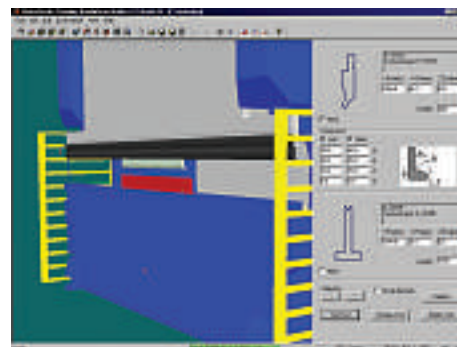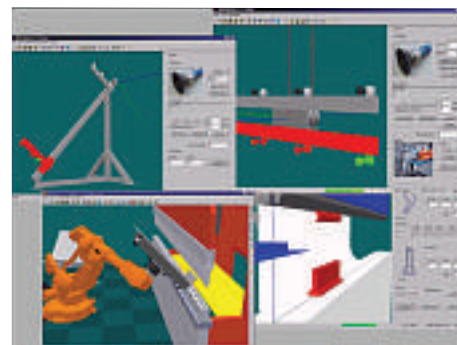
Easy to work with

Working with BendWizard couldn't be easier. If the part already exists in a CAD environment, all the operator has to do is import the drawing – usually an .iges or .dxf file – in order to examine its geometry. For parts which have to be designed from scratch, BendWizard has CAD functions for the geometric definition.

Before a feasibility check can be carried out, the part has first to be visualized. Two views of the imported drawing are possible: a two-dimensional view which shows the part as a flat sheet,

and a three-dimensional view which shows the folded sheet and lets the user modify the fold angles in real time.

The next step is to set up the cell components. The operator of the press brake machine imports the profiles of the punches and dies from appropriate libraries and then defines the length and the position of every single set of tools.

Depending on the dimensions of the sheet and on its geometry, it may be possible during the bending sequence to set up the gripper and correctly position the vacuum cups, even the magnets. A similar environment is provided for setting up the overturning equipment, which is necessary when the part has a counter-fold.

Programming

Moving on to the programming environment, the user sees here a 3D model of the cell with all the peripherals equipped exactly as required and in their exact position.

Programming of the system takes place interactively, with the software guiding the operator through the different robot cycle phases:

- Loading the sheet from the feeding system
- Double-thickness control (only one part in the robot's gripper)
- Centering
- Bending sequence
- Overturning and palletization

After verification of the complete cycle, the bending sequence can be downloaded to the workcell. Production can start just as soon as the final verification is received from the shop floor.

BendWizard fits perfectly into ABB's Industrial[IT] architecture. Open interfaces to CAD/CAM tools enable it to retrieve production data from a common server for direct transfer to the shop floor. This direct, vertically integrated link between the production environment and the CAD office allows, for example, modifications to product drawings to be sent automatically to the robot.
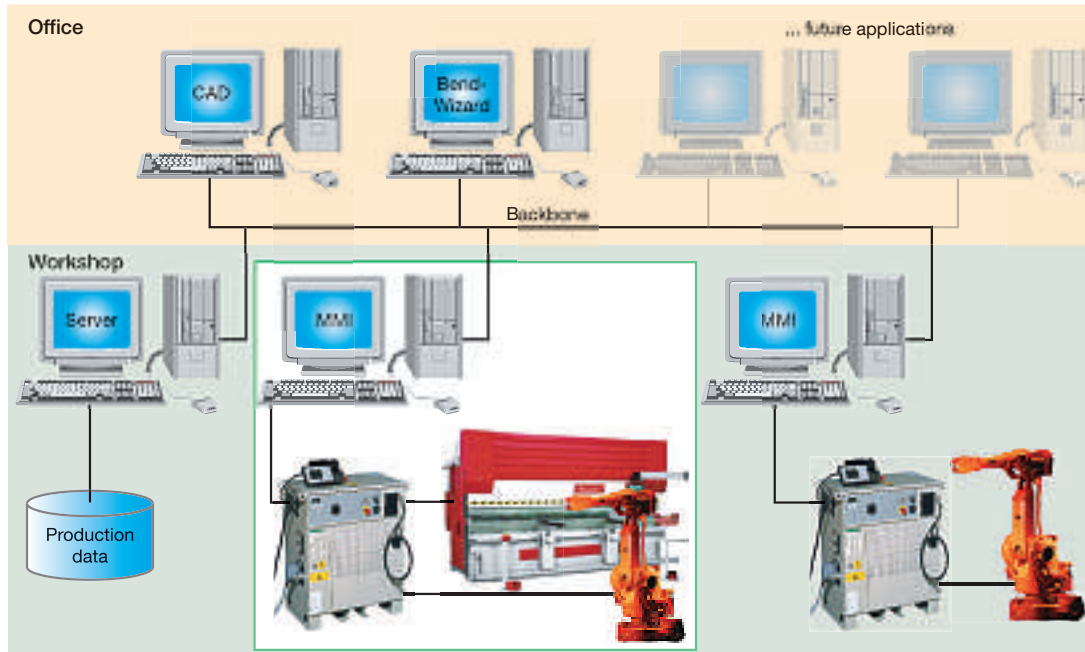
Full integration and Industrial[IT]

BendWizard includes standard Application Program Interfaces to controller programming languages that allow operators of press brakes from ABB-preferred partners to use one programming tool throughout the production cell. Besides reducing the necessary programming, BendWizard's ability to generate a part program provides for an unparalleled level of integration between the robot and press brake. This makes it the ideal offline pro-gramming tool for a 'new', fully integrated machine: the robotized press brake cell.

The success of these interfaces is highlighted by press brake builders who have developed proprietary post-processors to connect to BendWizard's APIs, and thereby delegate to this powerful software tool the programming tasks of their own machines. Bendwizard also has open interfaces to CAD/CAM tools (eg, unfolding tools) for metal fabrication and can retrieve production data from a common server for immediate transfer to the shop floor, ie to the press and the robot.

BendWizard further represents a milestone in integrated offline programming for the metal fabrication sector and fits perfectly into ABB's Industrial[IT] architecture [2]. Working together with other tools based on the same platform, it provides a direct, vertically integrated link between the production environment and the CAD office. Modifications to product drawings, for example, can be immediately transferred to the production environment.

This and other benefits of BendWizard are ensuring that it will play a key role in shaping the future of this sector.

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